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Research Article

Examining the Relationships between Academic Intrinsic Motivation, Online Learning Self-Efficacy, and Online Student Engagement: A Study on Distance Education Students

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Abstract

This research explored the relationships between online learning self-efficacy, academic intrinsic motivation, and student engagement in online learning, with particular attention given to the mediating role of academic intrinsic motivation on self-efficacy's influence on engagement. A research model was formulated in alignment with the study's hypotheses. Using a quantitative approach, the study applied both descriptive and relational survey models. The sample comprised 185 associate degree students participating in a distance education program at a state university. Data collection was conducted through a structured questionnaire. The research model and hypotheses were tested using the Partial Least Squares Structural Equation Modeling (PLS-SEM) method. The findings supported the hypotheses, revealing that online learning self-efficacy positively influenced both academic intrinsic motivation and student engagement. Additionally, it was discovered that online learning self-efficacy indirectly affected engagement, with academic intrinsic motivation serving as a mediator.

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Introduction

Online education is becoming increasingly prevalent in higher education institutions due to the flexibility and accessibility provided by technology (Getenet et al., 2024; Koca et al., 2024). However, students' full participation and success in online education largely depend on individual characteristics. These individual traits can include student satisfaction, academic resilience, performance, and motivation levels, all of which are closely linked to academic achievement (Chau & Cheung, 2018). Specifically, students' positive personal attitudes toward distance learning significantly contribute to the educational process (Koca et al., 2024).

During the COVID-19 pandemic, numerous studies have explored various aspects of distance education, focusing on its rapid implementation and the challenges it posed. Key

areas of research included the effectiveness of emergency distance education models in higher education (Bergdahl & Nouri, 2021), the psychological and emotional impacts on students and educators (Casacchia et al., 2021), and the role of technology in supporting online learning environments (Chang et al., 2022). Additionally, studies examined inequalities in access to online learning, highlighting the digital divide and its implications for educational equity (Devkota, 2021). Researchers also analyzed factors such as motivation, self-efficacy, and student engagement, emphasizing their critical role in fostering persistence and reducing procrastination during online learning (Pelikan et al., 2021). Furthermore, during the COVID-19 pandemic, studies explored parents' perspectives on distance education for first-grade students (Aruğaslan et al., 2022) and the needs of early childhood educators in remote teaching contexts (Alan, 2021). These studies collectively underscore the transformative effects of the pandemic on education and highlight the need for sustainable and inclusive distance learning practices.

With the increase in online education areas due to the COVID-19 pandemic, it became evident that individual factors like motivation and self-efficacy have significant impacts on online learning (Özüdoğru, 2022; Yu, 2022). These factors are considered key to successful learning experiences (Mamolo, 2022). Additionally, online student engagement plays a crucial function in education success. Online student engagement is a multidimensional concept that involves students' interactions with course materials, instructors, and peers (Turk et al., 2024). Online learning relies on innovative approaches, including content delivery via the Internet, with a focus on digital communication and learning resources. However, as student engagement has traditionally been examined in face-to-face classroom settings, its role in online learning remains a relatively new area of research requiring further investigation (Salas-Pilco et al., 2022). Studies indicate that student engagement is positively linked to academic success (Bond et al., 2020). Additionally, the level of engagement is thought to be influenced by individual characteristics such as intrinsic motivation and online learning self-efficacy (Alemayehu & Chen, 2023).

Although numerous studies have investigated various aspects of online education, especially during and after the COVID-19 pandemic period, the interrelationships between academic intrinsic motivation, online learning self-efficacy, and online student engagement in distance education contexts remain understudied. While existing research has examined these factors separately or in paired relationships - such as the impact of self-efficacy on

academic performance and online learning (Peteros et al., 2022), students' self-efficacy perceptions and attitudes towards distance education (Kaya et al., 2024; Özaydin Özkara & Ibili, 2021), the relationship between motivation and student engagement in online learning environments (Ferrer et al., 2022), the mediating effects of self-efficacy between motivation and learning engagement (Alemayehu & Chen, 2023), and the mediating role of self-efficacy in online learning engagement (Wang et al., 2022) - there is a notable gap in understanding how these three critical factors interact within distance education settings. Few studies have investigated the mediating role of academic intrinsic motivation in the relationship between online learning self-efficacy and student engagement (Aboobaker & Muneer, 2022; Alemayehu & Chen, 2023). This research approach of examining the mediating role of academic intrinsic motivation provides three key contributions to the field: (1) it offers a comprehensive understanding of how these three critical factors work together in online learning environments, (2) it reveals the specific mechanisms through which self-efficacy influences student engagement via intrinsic motivation, and (3) it provides evidence-based insights for developing more effective online learning strategies. This study aims to address this research gap by examining these relationships in an integrated framework. As universities continue to develop and expand their online education programs, this understanding becomes essential for enhancing student engagement and academic achievement in virtual learning settings.

Conceptual Framework

Academic Intrinsic Motivation

Motivation is one of the key factors that encourages students to actively participate in educational activities and ensures the success of teaching activities. Motivation refers to the driving force that prompts individuals to engage in a specific action and sustains that behavior over time (Akhtar et al., 2017; Fırat et al., 2018). An individual's motivation for an activity can arise from intrinsic or extrinsic reasons, or from a mix of both (Uyulgan & Akkuzu, 2014). Researchs show that students with intrinsic motivation are more successful and task-oriented compared to those with extrinsic motivation (Goodman et al., 2011).

Motivation is largely a multidimensional and non-cognitive construct. Academic motivation, more specifically, relates to cognitive, behavioral, and emotional factors such as creative thinking, learning skills, school satisfaction, continuity, and assignment performance (Uyulgan & Akkuzu, 2014). Academic intrinsic motivation refers to a student's internal

desire and willingness to learn. In this type of motivation, the learning process occurs based on the individual's own interest and curiosity, meaning that the student enjoys learning independently of external rewards or pressures (Deci & Ryan, 2000). Pelikan et al. (2021) suggest that self-determination theory highlights the importance of fulfilling three fundamental psychological needs—autonomy, competence, and social relatedness—which significantly influence intrinsic motivation and subsequently impact the level of active or passive learning behavior. Students with high academic intrinsic motivation tend to participate more in classes, interact actively with learning materials, and engage in deeper learning. This motivation type contributes not only to successfully completing courses but also to feeling competent and satisfied with academic experiences (Nguyen & Chen, 2023).

In relation to distance and online learning, the importance of academic intrinsic motivation becomes even more pronounced. Students in online environments often need more self-discipline and independent study skills (Kaye, 1989). The ability to self-motivate plays a critical role in this process. Students with high intrinsic motivation adapt more easily to online learning environments and cope better with challenges they encounter during the learning process (Martens et al., 2004; Uçar, 2019). Intrinsic motivation sparks and sustains interest in self-directed learning in e-learning environments for distance education students, making it essential to understand their intrinsic motivation to provide effective e-learning environments. In e-learning environments, learners need intrinsic motivation to maintain sustainability in their work (Fırat et al., 2018).

Online Learning Self-Efficacy

Self-efficacy is defined as an individual's evaluation of their capability to effectively perform tasks in a given domain (Bates & Khasawneh, 2007; Wang et al., 2013). Individuals with higher self-efficacy tend to exert greater effort in overcoming obstacles in that area (Bandura & Adams, 1977). Within online learning environments, self-efficacy pertains to learners' perceptions of their ability to meet the demands of online coursework (Zimmerman & Kulikowich, 2016).

In relation to distance and online learning, self-efficacy is a key determinant of students' success and their level of course engagement. Online learning environments require students to work more autonomously and make effective use of technology. Students with high self-efficacy tend to interact more with online materials, complete tasks efficiently, and remain resilient when facing difficulties. Horzum and Cakir (2009) identified three

dimensions of self-efficacy in distance learning: technological, content-related, and self-efficacy for distance learning. Koca et al. (2024) found that self-efficacy partially mediated the link between attitudes toward distance learning and satisfaction with academic life. Thus, self-efficacy is critical for success in online learning environments (Prior et al., 2016).

Online Student Engagement

Online learning is a technology-based educational method that provides students with various internet-based tools and learning environments, enabling them to access content, participate in discussions, submit assignments, and engage in interactive activities regardless of time and location constraints (Hu & Li, 2017; Hu et al., 2016). This flexibility and interaction strengthen students' relationships with course materials, instructors, and peers, thereby highlighting the importance of online student engagement. Engagement reflects students' active participation in courses, sustained interest in learning materials, and their overall motivation for the learning process (Bolliger & Martin, 2018). Engagement in online learning can be broken down into three essential dimensions: cognitive, emotional, and behavioral. Cognitive engagement refers to students' mental focus on the learning process; emotional engagement involves the development of positive emotions related to the course; and behavioral engagement entails active participation in course activities and interactions (Bond et al., 2020; Hu et al., 2016; Hu & Li, 2017). Maintaining student engagement is critical, as it directly affects their participation in courses and success in the learning process (Hari Rajan et al., 2024; Hu & Li, 2017). Students who exhibit high levels of engagement take on more active roles in online courses, assume responsibility, and devote more time to learning materials, thus facilitating effective online learning.

Literature Review and Research Hypotheses

The online learning literature has extensively focused on topics such as academic intrinsic motivation, self-efficacy in online learning, and student engagement. However, most studies have investigated these variables individually, with limited research exploring all their interrelationships. When reviewing the literature, it is evident that studies have examined the effects of intrinsic motivation on student success (Akhtar et al., 2017; Goodman et al., 2011; Martens et al., 2004; Meng & Hu, 2022), the desire to learn (Uyulgan & Akkuzu, 2014), and its relationship with online engagement (Hari Rajan et al., 2024). Studies have also investigated the impact of self-efficacy on students' course performance in online learning (Bates & Khasawneh, 2007; Prior et al., 2016), the function of self-efficacy as a mediator in the

link between academic life satisfaction and (Koca et al., 2024) and the relationship between course outcomes, self-regulated learning, and technology self-efficacy (Wang et al., 2013). Studies on student engagement also include topics such as how online student engagement enhances the learning experience (Bolliger & Martin, 2018; Turk et al., 2024), the effect of self-efficacy on online engagement (Getenet et al., 2024; Yi et al., 2024), and review studies on online student engagement (Hu & Li, 2017). Therefore, it can be concluded that both academic intrinsic motivation and self-efficacy in online learning are key factors influencing students' engagement and success in online education.

Academic Intrinsic Motivation and Online Student Engagement

Numerous studies have delved into the significance of intrinsic motivation in academic achievement and the learning process. Findings from these studies suggest that intrinsic motivation in both teachers and students enhances learning outcomes and engagement. Akhtar et al. (2017) studied the connection between teachers' intrinsic motivation and students' academic success, showing a strong positive link. Goodman et al. (2011) examined the roles of intrinsic and extrinsic motivation, with effort as a mediator, in influencing university students' academic performance, concluding that intrinsic motivation is the most reliable predictor of success. Martens et al. (2004) explored the role of intrinsic motivation in e-learning, observing that students with high intrinsic motivation engaged in more exploratory activities rather than focusing solely on knowledge acquisition. Nonetheless, intrinsic motivation was found to have an indirect effect on learning outcomes.

Meng and Hu (2022) explored the influence of students' intrinsic and extrinsic motivation on academic performance, showing that extrinsic motivation positively impacts academic performance both directly and indirectly, while intrinsic motivation affects performance only indirectly. Nguyen and Chen (2023) identified positive direct and indirect relationships among the success of information systems, intrinsic learning motivation, and self-regulated online learning in online education. In a study by Uyulgan and Akkuzu (2014), the effect of various intrinsic and extrinsic factors (learning environments, students' grade levels, academic success, and their desire to become teachers) on the academic intrinsic motivation of prospective teachers was examined. The results showed significant differences between students' intrinsic motivation, academic success, grade levels, and their desire to become teachers, with students who had a strong desire to become teachers also having higher intrinsic motivation. Hari Rajan et al. (2024) highlighted the need for teachers to

develop strategies that foster intrinsic motivation to boost student engagement and motivation in online environments. They also underscored the significance of creating a positive learning atmosphere by implementing approaches that nurture student engagement, motivation, and a sense of belonging.

In online learning environments, the absence of a physical classroom makes strong intrinsic motivation a key advantage for students. Those with high academic intrinsic motivation are more inclined to engage with online materials and activities, enhance their independent study habits, and perform better in courses. Consequently, it has been concluded that intrinsic motivation significantly impacts online student engagement, leading to the formulation of the study's first hypothesis as follows:

Hypothesis 1: Academic intrinsic motivation has a positive and significant impact on online student engagement.

Online Learning Self-Efficacy and Online Student Engagement

Studies within the domain of online and distance education have demonstrated that self-efficacy significantly impacts course satisfaction, academic achievement, and student engagement. Bates and Khasawneh (2007) investigated how university students view their self-efficacy concerning online learning systems and their involvement with these platforms. The findings indicated that self-efficacy served as a partial mediator between students' outcome expectations and their perceptions of learning mastery. Furthermore, prior online learning experience and perceived success with these systems were identified as important factors contributing to the development of self-efficacy. In their research, Prior et al. (2016) examined the effects of self-efficacy and attitudes toward digital literacy, noting that students with higher self-efficacy were more likely to interact with peers, make frequent use of the learning management system, and engage more effectively with instructors. The study highlights the importance of developing strategies to enhance students' self-efficacy in the context of online education.

Koca et al. (2024) examined the mediating role of academic self-efficacy in the relationship between students' perceptions of distance education and their academic life satisfaction. Their findings revealed that academic self-efficacy served as a partial mediator in this relationship. In another study, Getenet et al. (2024) investigated the influence of students' attitudes toward digital technology, digital literacy, and self-efficacy on their engagement in online learning. The study found that favorable attitudes toward technology

and higher levels of digital literacy significantly boosted self-efficacy in online environments. Furthermore, self-efficacy had a positive impact on various aspects of student engagement, including social, cognitive, behavioral, and emotional dimensions. Yi et al. (2024) explored the role of belonging, academic self-efficacy, and resilience in student engagement in distance learning, concluding that both self-efficacy and resilience positively contributed to different facets of engagement.

Having strong self-efficacy beliefs enables students to take on active roles in their interactions with courses and enhances their engagement in online courses. Particularly in distance education, student engagement and success largely depend on their confidence in their abilities to perform in online environments. Thus, it is expected that self-efficacy in online learning will positively and significantly influence student engagement. In line with this assumption, the study's second hypothesis is formulated as follows:

Hypothesis 2: Online learning self-efficacy has a positive and significant impact on online student engagement.

Online Learning Self-Efficacy and Academic Intrinsic Motivation

Research consistently shows that students' beliefs about their self-efficacy have a substantial influence on their academic motivation (Lin et al., 2022). Learners with strong academic self-efficacy are more likely to dedicate time to their studies and navigate educational challenges effectively, which leads to greater academic achievement (Pajares & Schunk, 2001). Numerous reviews in the literature discuss studies examining the relationship between self-efficacy and intrinsic motivation in both online and blended learning environments. These studies emphasize the crucial role self-efficacy and intrinsic motivation play in shaping student satisfaction, attitudes, and academic performance.

Li et al. (2017) investigated how computer self-efficacy, intrinsic motivation, attitudes, and satisfaction are related within blended learning environments. Their findings indicated that higher intrinsic motivation positively influenced satisfaction, while computer self-efficacy impacted both motivation and attitudes. Yu et al. (2022) analyzed emotional self-efficacy profiles among online learners and studied their connections to self-regulation, motivation, and academic success. This study highlighted the role of emotional self-efficacy in supporting self-regulation and motivation in online learning. Alesi et al. (2024) explored the mediating effect of academic motivation between self-efficacy and learning strategies,

revealing that students with lower self-efficacy also exhibited lower motivation and employed fewer strategic learning approaches.

Self-efficacy in online learning can enhance students' intrinsic motivation by boosting their confidence in overcoming challenges during the learning process. Those with strong self-efficacy are generally more motivated to engage in online studies and take greater responsibility for their learning. This, in turn, bolsters their academic intrinsic motivation, leading to greater interest, participation, and success in courses. Consequently, exploring the positive impact of self-efficacy on academic intrinsic motivation is essential for enhancing students' academic performance and learning experiences. Given this assumption, the study's third hypothesis is presented as follows:

Hypothesis 3: Online learning self-efficacy has a positive and significant impact on academic intrinsic motivation.

The Mediating Effect of Academic Intrinsic Motivation

Academic intrinsic motivation plays a key role in driving students to engage deeply with learning content and sustaining their internal desire to learn. In online learning settings, students' success and active participation depend not only on their self-efficacy beliefs but also on the strength of their intrinsic motivation. While self-efficacy enhances students' confidence in their ability to succeed in online learning, this confidence is shaped by both cognitive and motivational influences. Students who possess high levels of intrinsic motivation are more likely to overcome challenges in online learning and engage more fully in the learning process (Boyd, 2002). Recent research has further emphasized that motivation significantly influences student engagement through the mediating effects of learning self-efficacy and self-monitoring in online environments (Alemayehu & Chen, 2023). Additionally, research conducted during the COVID-19 pandemic has highlighted the connection between basic need satisfaction, procrastination, and persistence in emergency distance learning settings. It was further demonstrated that intrinsic motivation mediates this relationship, emphasizing its central role in fostering persistence and reducing procrastination in challenging online learning environments (Pelikan et al., 2021). Consequently, it is hypothesized that academic intrinsic motivation acts as a mediator in the relationship between online learning self-efficacy and student engagement.

Students with robust self-efficacy beliefs tend to show greater persistence in overcoming obstacles and are more likely to exert the necessary effort to successfully

complete tasks, particularly when equipped with the relevant skills (Hong et al., 2017). It is assumed that academic intrinsic motivation further amplifies this relationship. Accordingly, the fourth hypothesis is formulated as follows:

Hypothesis 4: Academic intrinsic motivation mediates the relationship between online learning self-efficacy and online student engagement.

Method

Research Model

This research employs a quantitative method to examine the connections between academic intrinsic motivation, online learning self-efficacy, and student engagement in a distance education context. A descriptive and correlational survey model was used for the study. Based on the literature review and previous research findings, four hypotheses were developed to investigate the relationships between these variables. The research model, illustrated in Figure 1, was constructed to test these hypotheses and reflect the theoretical relationships between online learning self-efficacy, academic intrinsic motivation, and online student engagement. The model proposes that online learning self-efficacy may influence both academic intrinsic motivation (H3) and online student engagement (H2), while academic intrinsic motivation may directly affect online student engagement (H1). Additionally, the model includes a mediating relationship (H4) to examine how academic intrinsic motivation might mediate the relationship between online learning self-efficacy and student engagement.

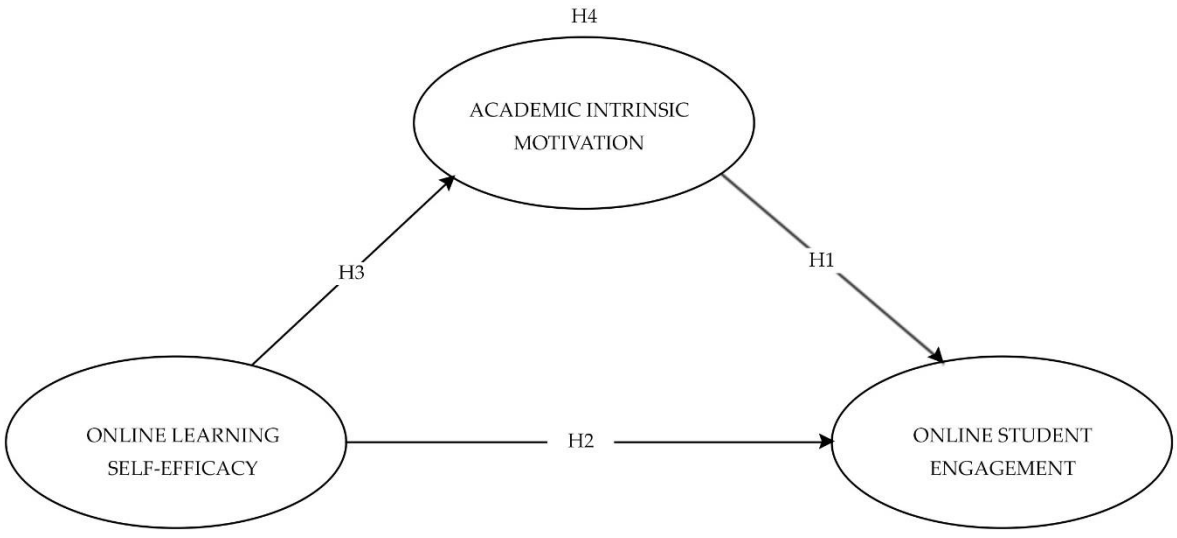

Figure 1. Research model

Participants

This research was conducted with a group of associate degree students enrolled in a state university's distance education program during the spring term of the 2023-2024 academic year. The participants, totaling 185 students, were selected using a convenience sampling technique (Table 1).

Table 1. Demographic informations

Demographic Variables		**n**	**%**
Gender	Female	127	68.6
	Male	58	31.4
Age	18-22 years	117	63.2
	23-27 years	41	22.2
	28-35 years	14	7.6
	35 years and older	13	7.0
Marital Status	Single	147	79.5
	Married	38	20.5
Employment Status	Employed	69	37.3
	Unemployed	116	62.7

Among the participants, 68.6% (n=127) were female and 31.4% (n=58) were male. The majority fell within the 18-22 age range, representing 63.2% (n=117) of the total sample. Other age groups included 23-27 years (22.2%, n=41), 28-35 years (7.6%, n=14), and those aged 35 and older (7.0%, n=13). Regarding marital status, 79.5% (n=147) were single, while 20.5% (n=38) were married. Concerning employment, 37.3% (n=69) were employed, whereas 62.7% (n=116) were not.

Data Collection Tools

Data for this research were collected using an online survey form consisting of four sections, distributed via Google Forms. The first section collected demographic details of the participants, while the remaining three sections contained the following scales:

Academic Intrinsic Motivation Scale: In this study, the Academic Intrinsic Motivation Scale, adapted into Turkish by Uyulgan and Akkuzu (2014), was used to determine students' levels of academic intrinsic motivation. The adaptation study included a participant group consisting of university students. The scale consists of four sub-dimensions: "Need for Achievement," "Social Acceptance," "Fear of Failure," and "Mastery," with a total of 23 items. The scale follows a 7-point Likert format with a range of response options. The goodness-of-fit indices of the scale were reported as $\chi 2 = 907.70$, df = 222, $\chi 2/df = 4.088$, RMSEA = 0.063, GFI = 0.91, CFI = 0.90, NNFI = 0.90, AGFI = 0.89, RMR = 0.19, and IFI = 0.90. The Cronbach's

Alpha coefficient for the overall scale was calculated as .77, indicating that the scale is both valid and reliable (Uyulgan & Akkuzu, 2014).

Online Student Engagement Scale: To measure students' engagement in online learning processes, the Online Student Engagement Scale, adapted into Turkish by Polat et al. (2022), was utilized. The adaptation study involved a participant group consisting of university students who received online education through synchronous and asynchronous methods over two semesters. Originally developed by Dixson (2010), the scale consists of four sub-dimensions: "Skills," "Emotion," " Engagement," and "Performance," with a total of 19 items. The scale uses a 5-point Likert format with a range of responses. The goodness-of-fit indices of the scale were calculated as $\chi 2$ = 273.84, df = 142, $\chi 2/df$ = 1.93, TLI = 0.93, CFI = 0.94, RMSEA = 0.06, SRMR = 0.06, RMR = 0.06, AGFI = 0.86, IFI = 0.94, PNFI = 0.74, and PGFI = 0.67. The reliability analysis of the scale indicated that Cronbach's Alpha values ranged between 0.77 and 0.87 across sub-factors. Therefore, the scale was determined to be valid and reliable (Polat et al., 2022).

Online Learning Self-Efficacy Scale: To measure students' perceptions of self-efficacy toward online learning, the Online Learning Self-Efficacy Scale, adapted to Turkish by Yörük and Özçetin (2021), was used. The adaptation study involved a participant group of university students. The scale consists of four sub-dimensions: " Technology use self-efficacy," "Online learning self-efficacy," "Instructor and peer interaction and communication self-efficacy," and "Self-control and motivation activity," with a total of 31 items. The scale uses a 6-point Likert format with varying response options. The goodness-of-fit indices of the scale were calculated as $\chi 2$ = 941.377, df = 413, RMSEA = 0.066, SRMR = 0.0411, and CFI = 0.96. The overall Cronbach's Alpha coefficient of the scale was found to be 0.973, while Cronbach's Alpha values for the sub-factors ranged between 0.951 and 0.977. Therefore, the scale was determined to be valid and reliable (Yörük & Özçetin, 2021).

Data Analysis

In this study, the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach was employed to analyze the research model and evaluate the hypotheses. The analyses were conducted using the SmartPLS 4.1.0.8 software. PLS-SEM is a method that facilitates the evaluation of structural models, particularly in cases where the sample size is small. Additionally, as this method does not require the assumption of normal distribution, it is widely preferred in the field of social sciences. For PLS-SEM analyses, the recommended

minimum sample size should be at least ten times the highest number of paths pointing to a single construct in the model (Hair et al., 2017). The sample size used in this study (n=185) exceeds the recommended threshold when considering the variables in the model. This approach enables the testing of both the measurement (outer) and structural (inner) models.

The data analysis commenced with an evaluation of the measurement model, focusing on the reliability and validity of the scales. Indicator reliability and internal consistency were assessed, with composite reliability (CR) and Cronbach's alpha calculated for internal consistency. Convergent validity was determined by analyzing the average variance extracted (AVE), and discriminant validity was verified using the Fornell-Larcker criterion.

After validating the measurement model, the structural model was analyzed to determine the causal relationships and assess the hypotheses. Path significance and relationship strength were examined using path coefficients, with bootstrapping employed for significance testing. The significance of the paths in the model and the strength of the relationships were analyzed through path coefficients, and their significance levels were tested using the bootstrapping method with 5,000 subsamples. Bootstrapping is a method that involves creating new samples by randomly resampling observations from the original dataset with replacement, and re-estimating the model for each sample to calculate t-values for the significance of the coefficients (Hair et al., 2017). Additionally, model performance was evaluated using R^2 values, effect size (f^2), and predictive relevance (Q^2).

Findings

Evaluation of the Measurement Model

In this research, the measurement model was assessed by analyzing factor loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) values.

When evaluating the factor loadings, it was observed that the fourth and sixth items in the "Social Acceptance" subdimension of the Academic Intrinsic Motivation scale had factor loadings lower than 0.40. According to Hair et al. (2017), if a factor loading is below 0.40, the contribution of that indicator to the model is considered insufficient, and it is recommended to remove the indicator from the model. Therefore, to improve the overall validity of the model, these indicators were excluded from the analysis. Table 2 shows that the remaining factor loadings range between 0.631 and 0.921. As Chin (1998) suggests, factor

loadings above 0.50 are considered acceptable, indicating that the indicators possess sufficient reliability.

When examining Cronbach's alpha and composite reliability (CR) values calculated for internal consistency, as presented in Table 2, it was found that Cronbach's alpha coefficients ranged from 0.813 to 0.957, and CR coefficients ranged from 0.880 to 0.962. As recommended by Henseler et al. (2016) and Hair et al. (2017), Cronbach's alpha and CR values above 0.70 are sufficient for reliability. This indicates that the constructs have high internal consistency.

Convergent validity was evaluated by reviewing the average variance extracted (AVE) values for each construct. AVE values greater than 0.50 indicate that convergent validity is achieved (Hair et al., 2017). As shown in Table 2, the AVE coefficients for the constructs range from 0.513 to 0.842.

Table 2. Loadings, Cronbach's Alpha, CR, and AVE

Scales	Subdimension	Items	Factor Loadings	Cronbach's Alpha	CR	AVE
Online Student Engagement	Skills (Sk)	sk1	0.755	0.896	0.918	0.615
		sk2	0.789			
		sk3	0.781			
		sk4	0.792			
		sk5	0.795			
		sk6	0.765			
		sk7	0.812			
	Emotion (Emt)	emt1	0.695	0.858	0.899	0.643
		emt2	0.872			
		emt3	0.873			
		emt4	0.737			
		emt5	0.817			
	Engagement (Eng)	eng1	0.852	0.877	0.911	0.672
		eng2	0.862			
		eng3	0.727			
		eng4	0.872			
		eng5	0.777			
	Performance (Per)	per1	0.915	0.813	0.914	0.842
		per2	0.921			
Academic Intrinsic Motivation	Need For Achievement (Nfa)	nfa1	0.739	0.878	0.908	0.622
		nfa2	0.827			
		nfa3	0.799			
		nfa4	0.742			
		nfa5	0.812			
		nfa6	0.807			
	Fear of Failure (Fof)	fof1	0.865	0.858	0.900	0.692
		fof2	0.771			
		fof3	0.829			
		fof4	0.859			

	Social Acceptance (Soa)	soa1	0.631	0.851	0.880	0.513
		soa2	0.737			
		soa3	0.713			
		soa5	0.644			
		soa7	0.755			
		soa8	0.776			
		soa9	0.741			
	Mastery (Mas)	mas1	0.780	0.839	0.892	0.675
		mas2	0.825			
		mas3	0.829			
		mas4	0.851			
Online Learning Self-efficacy	Online Learning Self-Efficacy (Ols)	ols1	0.869	0.913	0.939	0.793
		ols2	0.898			
		ols3	0.907			
		ols4	0.889			
	Self-control and Motivation Activity (Scma)	scma1	0.636	0.957	0.962	0.661
		scma10	0.830			
		scma11	0.818			
		scma12	0.787			
		scma13	0.783			
		scma2	0.828			
		scma3	0.872			
		scma4	0.857			
		scma5	0.859			
		scma6	0.862			
		scma7	0.856			
		scma8	0.728			
		scma9	0.822			
	Instructor and Peer Interaction and Communication Self-Efficacy (Ips)	ips1	0.876	0.945	0.955	0.752
		ips2	0.867			
		ips3	0.864			
		ips4	0.866			
		ips5	0.860			
		ips6	0.872			
		ips7	0.864			
	Technology Use Self-Efficacy (Tus)	tus1	0.748	0.935	0.948	0.723
		tus2	0.854			
		tus3	0.911			
		tus4	0.875			
		tus5	0.835			
		tus6	0.851			
		tus7	0.866			

Discriminant validity was evaluated using the criterion proposed by Fornell and Larcker (1981). They recommend that the square root of each construct's AVE should exceed the correlation coefficients between the constructs, ensuring discriminant validity for the model. As presented in Table 3, this requirement has been satisfied.

Table 3. Discriminant validity

	Sk	Emt	Eng	Per	Nfa	Fof	Soa	Mas	Ols	Scma	Ips	Tus
Sk	0.784*											
Emt	0.731	0.802*										
Eng	0.503	0.588	0.820*									
Per	0.600	0.493	0.452	0.918*								
Nfa	0.527	0.547	0.320	0.514	0.789*							
Fof	-0.063	0.018	0.032	0.007	0.076	0.832*						
Soa	0.114	0.154	0.216	0.125	0.180	0.472	0.716*					
Mas	0.453	0.520	0.393	0.432	0.599	0.190	0.286	0.822*				
Ols	0.278	0.233	0.122	0.293	0.477	-0.025	-0.123	0.385	0.891*			
Scma	0.462	0.500	0.341	0.355	0.541	0.024	0.000	0.501	0.662	0.813*		
Ips	0.431	0.484	0.536	0.291	0.421	0.038	0.113	0.449	0.466	0.733	0.867*	
Tus	0.259	0.241	0.136	0.283	0.438	-0.023	-0.052	0.323	0.804	0.596	0.451	0.850*

Evaluation of Formative Constructs

In this study, constructs of online learning self-efficacy (self-efficacy), academic intrinsic motivation (motivation), and online student engagement (engagement) were evaluated as formative higher-order constructs. The validity of these constructs was evaluated following the guidelines outlined by Hair et al. (2017). Initially, the variance inflation factor (VIF) values were assessed to check for multicollinearity among the formative higher-order constructs, followed by an analysis of the significance of indicator weights and loadings.

As shown in Table 4, all VIF values are below 5, indicating no multicollinearity issues (Hair et al., 2011).

Indicator weights and loadings were assessed for statistical significance using the bootstrapping technique with 5000 resamples. The results indicated that the weights of the emt, nfa, mas, and scma subdimensions were statistically significant. However, the weights of the sk, eng, fof, soa, ols, ips, and tus were not statistically significant ($p > 0.05$). Nevertheless, the loadings of sk, eng, ols, ips, and tus were greater than 0.50 and statistically significant, so these lower-order constructs were not removed from the measurement model of the higher-order constructs. Since the loadings of fof and soa were below 0.50 and not statistically significant, these subdimensions were removed from the model to improve its overall validity (Hair et al., 2014). The analysis results are presented in Table 4.

Table 4. VIF values, indicator weights, and loadings

Higher-order Construct	Lower-order Construct	VIF	Weight	t-value	p-value	Loading	t-value	p-value
Engament	Sk	2.569	0.219	1.550	0.061	0.859	16.874	0.000***
	Emt	2.496	0.571	4.120	0.000***	0.915	20.264	0.000***
	Eng	1.617	0.005	0.037	0.485	0.616	5.864	0.000***
	Per	1.641	0.367	2.873	0.002**	0.782	11.008	0.000***
Motivation	Nfa	1.565	0.643	7.379	0.000***	0.921	27.251	0.000***
	Fof	1.297	-0.093	1.050	0.147	0.017	0.147	0.442
	Soa	1.359	-0.072	0.662	0.254	0.142	1.108	0.134
	Mas	1.656	0.497	5.349	0.000***	0.844	17.001	0.000***
Self-efficacy	Ols	3.339	0.106	0.449	0.327	0.722	7.792	0.000***
	Scma	3.030	0.677	4.618	0.000***	0.977	36.973	0.000***
	Ips	2.175	0.272	1.639	0.051	0.841	10.543	0.000***
	Tus	2.903	0.050	0.259	0.398	0.662	6.618	0.000***

**p<0.01, ***p<0.001

Evaluation of the Structural Model

In this model, the Bootstrapping technique (with 5000 subsamples) was employed to determine the statistical significance of the path coefficients within the proposed research framework. The findings revealed that motivation had a significant direct positive effect on engagement ($\beta = 0.529$, $t = 6.869$, $p < 0.001$), self-efficacy also had a significant positive effect on engagement ($\beta = 0.218$, $t = 2.484$, $p < 0.01$), and self-efficacy positively influenced motivation ($\beta = 0.598$, $t = 11.962$, $p < 0.001$). As a result, Hypotheses H1, H2, and H3 were confirmed (see Table 5). To assess the mediating role of motivation in the link between self-efficacy and engagement, the indirect effects were analyzed. The results showed that self-efficacy had a positive indirect impact on engagement ($\beta = 0.316$, $t = 6.282$, $p < 0.001$), indicating that motivation serves as a mediator in the self-efficacy and engagement relationship. Consequently, Hypothesis H4 was also supported (see Table 5).

Table 5. Hypothesized path coefficients, t-values, and hypothesis results

					Confidence intervals		
	β	Stdev	t-value	p-value	Lower 2.5%	Upper 97. 5%	Results
Direct effect							
H1. Motivation -> Engagement	0.529	0.077	6.869	0.000	0.366	0.670	Supported
H2. Self-efficacy -> Engagement	0.218	0.088	2.484	0.007	0.053	0.399	Supported
H3. Self-efficacy -> Motivation	0.598	0.050	11.962	0.000	0.507	0.700	Supported
Indirect effect							
H4. Self-efficacy -> Motivation -> Engagement	0.316	0.05	6.282	0.000	0.224	0.422	Supported

The explanatory strength of the model's dependent variables was assessed using R^2 values. For engagement, the R^2 value was 0.465, indicating that 46.5% of the variation in

engagement is explained by the independent variables, which include motivation and self-efficacy. Similarly, the R^2 value for motivation was found to be 0.357, meaning that self-efficacy explains 35.7% of the variance in motivation. According to Chin (1998), R^2 values exceeding 0.67 are regarded as strong, values between 0.33 and 0.67 as moderate, and values from 0.19 to 0.33 as weak. Based on this categorization, the R^2 values for engagement and motivation suggest that the model possesses moderate explanatory power (Figure 2).

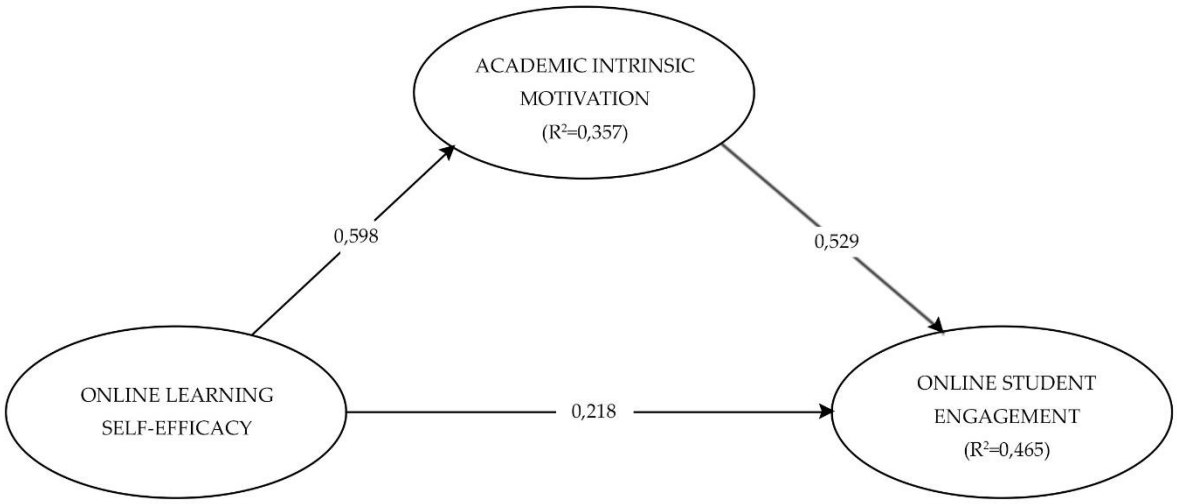

Figure 2. Research model results

To assess the influence of independent variables on the dependent variables within the model, effect size (f^2) values were analyzed. These values reflect the degree to which one variable impact another. As per Cohen's (1988) guidelines, f^2 values of 0.02, 0.15, and 0.35 correspond to small, medium, and large effects, respectively. The f^2 values derived from the analysis are detailed in Table 6. The f^2 value for motivation's impact on engagement was 0.336, suggesting a medium effect, meaning that motivation significantly contributes to student engagement. For the effect of self-efficacy on engagement, the f^2 value was 0.057, signifying a small effect. While self-efficacy is statistically significant in its impact on engagement, the strength of this influence is relatively modest. Lastly, self-efficacy's effect on motivation was assigned an f^2 value of 0.556, representing a large effect. This highlights the pivotal role of self-efficacy in the model as a key predictor of motivation.

Table 6. f^2 values

	f^2
Engagement	
Motivation	0.336
Self-efficacy	0.057
Motivation	
Self-efficacy	0.556

In order to determine the predictive relevance of the structural model, Q^2 values were evaluated, following the guidelines of Stone (1974) and Geisser (1974). A Q^2 value exceeding zero demonstrates the model's capacity to predict dependent variables accurately. Specifically, the Q^2 value for engagement was 0.239, while for motivation, it was 0.316, indicating that the model holds predictive relevance for both engagement and motivation, with a stronger predictive capacity for motivation.

Discussion and Conclusion

This research explored the relationships between online learning self-efficacy, academic intrinsic motivation, and online student engagement, with a particular focus on the mediating role of academic intrinsic motivation in the connection between self-efficacy and engagement. The results from the structural model demonstrate that academic intrinsic motivation directly affects online student engagement, and that self-efficacy has direct effects on both academic intrinsic motivation and engagement. Furthermore, self-efficacy indirectly influences student engagement through academic intrinsic motivation, highlighting the mediating role of motivation in this relationship.

These findings align with previous research on the complex relationships between engagement and other learning variables in online environments. For instance, Wang et al. (2022) found that learner-content and learner-learner interactions predicted online learning engagement, with online learning self-efficacy and academic emotions serving as mediators. Their study demonstrated that both types of interactions influenced learning engagement through the sequential mediation of online learning self-efficacy and academic emotions, further supporting the important role of self-efficacy in fostering engagement.

The study's findings indicate that academic intrinsic motivation positively influences online student engagement. This result indicates that students with high intrinsic motivation are more engaged in online learning. A review of the literature shows that intrinsic motivation is closely related to academic achievement, learning performance, engagement in courses (Ferrer et al., 2022), and learning strategies. Akhtar et al. (2017) and Goodman et al. (2011) emphasized that intrinsic motivation enhances the academic performance of both teachers and students, while Meng and Hu (2022) stated that intrinsic motivation indirectly influences academic success. Martens et al. (2004) and Nguyen and Chen (2023) found that intrinsic motivation helps students participate in online learning processes with a more exploratory mindset, although its direct effect on learning outcomes is limited. Uyulgan and

Akkuzu (2014) demonstrated that the intrinsic motivation of prospective teachers is related to their academic success, career goals, and the learning environments they experience. H. Rajan et al. (2024) emphasized the necessity for educators to create methods that encourage students' intrinsic motivation, which is key to enhancing both motivation and involvement in virtual learning contexts. Likewise, Liu et al. (2024) demonstrated that both intrinsic and extrinsic motivation, alongside emotional involvement and psychological resilience, have a strong effect on academic outcomes. Moreover, extrinsic motivation was shown to have a positive influence on intrinsic motivation, emotional engagement, and psychological resilience, with intrinsic motivation serving as an intermediary between extrinsic motivation and academic performance. Recent research has shown that motivation has both direct and indirect effects on learning engagement through learning self-efficacy and self-monitoring, although the direct influence was not strong. The findings revealed that learning self-efficacy and self-monitoring partially mediated the influence of motivation on learning engagement in online learning environments (Alemayehu & Chen, 2023).

A significant outcome of the research is that self-efficacy in online learning positively influences student engagement in digital education environments. Self-efficacy has a notable impact on engagement, both directly and indirectly, by influencing motivation. Previous studies have consistently highlighted the critical role self-efficacy plays in enhancing student engagement, motivation, and academic achievement in online contexts. Bates and Khasawneh (2007), as well as Prior et al. (2016), stressed that self-efficacy empowers students to utilize online platforms more efficiently and engage more actively in learning activities. Learning motivation and computer self-efficacy have been found to positively affect students' learning engagement, with computer self-efficacy showing a more significant impact (Aboobaker & Muneer, 2022). Moreover, Wang et al. (2013) and Getenet et al. (2024) underscored those greater levels of technological self-efficacy and digital competence boost student motivation and satisfaction with their coursework. Yi et al. (2024) observed that self-efficacy positively influences cognitive, emotional, and behavioral engagement, while Koca et al. (2024) found that self-efficacy serves as a partial mediator between students' attitudes toward distance education and their academic life satisfaction.

One of the study's notable findings is the strong influence self-efficacy has on intrinsic motivation. Several studies have explored the connection between self-efficacy and intrinsic motivation in both blended and online learning environments. Li et al. (2017) identified that

computer self-efficacy impacts intrinsic motivation and attitudes, with higher intrinsic motivation positively affecting satisfaction. Yu et al. (2022) highlighted that emotional self-efficacy is closely linked to self-regulation and motivation in online learning. Alesi et al. (2024) further found that academic motivation serves as a partial mediator between self-efficacy and learning strategies, noting that students with lower self-efficacy employ fewer strategic learning techniques. These insights illustrate the significant role of self-efficacy and motivation in driving success and satisfaction in learning. In the current study, the mediating role of academic intrinsic motivation between online learning self-efficacy and student engagement was also explored, confirming that academic intrinsic motivation acts as a mediator in this relationship. Overall, the study demonstrates the importance of self-efficacy and academic intrinsic motivation in fostering student engagement in online learning.

Limitations and Suggestions

The data collection process in this study was conducted within a specific time frame, and long-term changes or lasting effects were not evaluated. Additionally, the participant group was limited to students enrolled in distance education environments at a single institution. Consequently, the perceptions of students from different educational levels or face-to-face learning contexts regarding motivation and self-efficacy were not examined, potentially limiting the generalizability of the findings. Another limitation of the study is that the PLS-SEM method used does not provide global model fit indices like CB-SEM, which restricts the ability to assess overall model fit.

Future research should consider including broader participant groups from diverse educational settings, such as face-to-face, hybrid, or K-12 education, to ensure the applicability of the results across various contexts. Furthermore, cross-institutional studies could provide deeper insights into how differing institutional practices shape motivation, self-efficacy, and engagement.

Longitudinal studies are needed to examine the long-term effects of self-efficacy and motivation, offering valuable insights into their sustained impact on engagement and success in online learning. Such designs would enable researchers to track how these constructs evolve over time and interact with each other to influence student outcomes. Finally, qualitative and experimental studies focusing on strategies to enhance self-efficacy and intrinsic motivation could provide a more nuanced understanding of their effects on student engagement and success. For instance, experimental designs could evaluate specific

interventions, such as gamified learning environments or personalized feedback systems, to determine their efficacy in improving motivation and engagement. Additionally, qualitative research exploring students' lived experiences could reveal complex dynamics underlying their motivational behaviors in online learning settings.

Ethical Committee Permission Information

Name of the board that carries out ethical assessment: Scientific Research and Publication Ethics Committee of Isparta University of Applied Sciences

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Author Contribution Statement

Emine ARUĞASLAN: *Conceptualization, design, literature review, methodology, data collection, data analysis, interpretation, writing, and editing.*

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